A Statewide Assessment of Vermont's Wadeable Streams 2018-2020

INTRODUCTION

Biomonitoring is the use of biological community surveys to assess stream health. Biological communities, such as fish and macroinvertebrates, are influenced by the range of physical and chemical conditions in a stream over time and integrate impacts from stressors at the local and watershed scale. As a direct measure of aquatic ecosystems, biological communities are a powerful tool for providing a **holistic assessment of stream health**. Water chemistry data and physical habitat observations are typically collected to help interpret the biological condition. Biomonitoring is a primary tool of the Vermont Department of Environmental Conservation (VTDEC) Watershed Management Division (WSMD) for evaluating the status of Vermont's wadeable streams and informing management decisions.

Figure 1. State scientists conduct biological surveys of macroinvertebrates (top) and fish (bottom).

Probabilistic monitoring is one method that the WSMD can use to evaluate progress towards achieving its goals of **protecting, maintaining, enhancing, and restoring Vermont's waters.** Unlike a targeted monitoring approach, probabilistic monitoring allows for an **unbiased assessment of the overall biological condition of Vermont's wadeable streams,** which represent approximately 90% of all stream miles in Vermont. Probabilistic monitoring also enables the WSMD to determine the extent to which biological condition in wadeable streams is changing over time and to help identify major stressors impact biological condition across the state. These core tenets of the Water Quality Monitoring Program Strategy enable the WSMD to fulfill the requirements of Section 305(b) of the Clean Water Act and U.S. Environmental Protection Agency (EPA).

The current design of the Vermont probabilistic survey of wadeable streams is based on a three-year rolling evaluation of 45 sites, or 15 randomly selected sites per year (**Figure 2**). Sites are provided by EPA and stratified by stream order using the National Hydrography Dataset. This report summarizes results from wadeable stream sites monitored in 2018, 2019 and 2020. Information on biomonitoring field and lab methods can be found in the WSMD Field Methods Manual and Biomonitoring Quality Assurance Project Plan. Detailed descriptions of the stream community types and applications of macroinvertebrate and fish metrics and IBIs can be found in the WSMD's biocriteria development documentation, and in Appendix G of the Vermont Water Quality Standards (VWQS).

BIOLOGICAL CONDITION OF VERMONT'S WADEABLE STREAMS

Results from probabilistic monitoring sites are used to calculate estimates for the percent of all Vermont wadeable stream miles in each assessment category for two biological community types: fish and macroinvertebrates. Each estimate is reported with a 95% confidence interval, which quantifies variability based on the sample size (**Figures 3 and 4**). The interval is very likely to contain the true proportion of streams in each category.

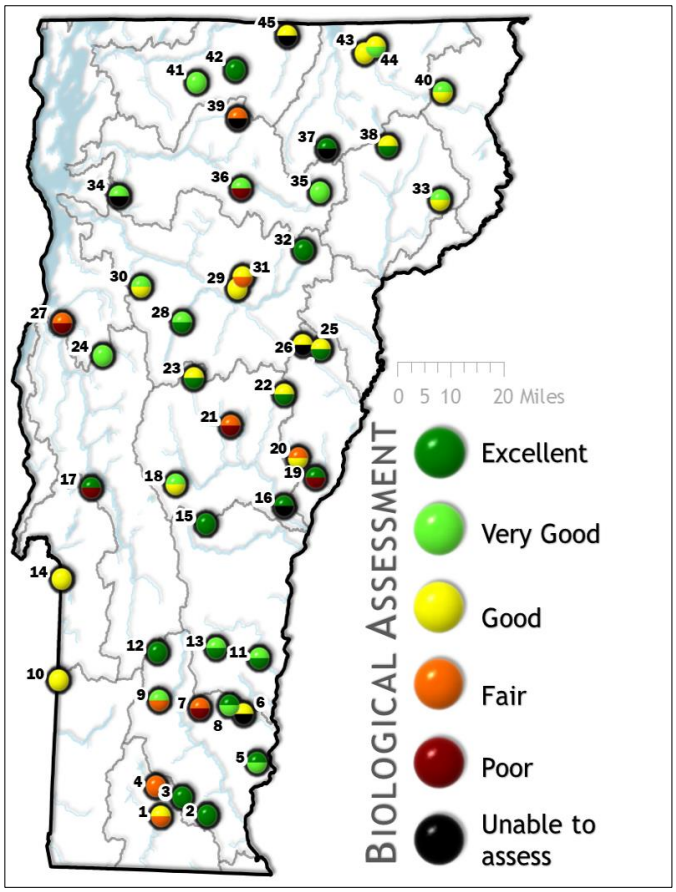

Figure 2. Location and assessment score of each site for macroinvertebrates (top half) and fish (bottom half).

More than half of wadeable stream miles in Vermont support at least one biological community of Very High Quality. Biological communities that receive an assessment rating of *Very Good* or *Excellent* are referred to as "Very High Quality." This term represents streams in, or minimally changed from their natural condition. The results of this survey estimate that **55% of wadeable stream miles in Vermont are Very High Quality for macroinvertebrates and 51% of wadeable stream miles are Very High Quality for fish.**

The majority of wadeable stream miles in Vermont meet or exceed biological criteria for Class B(2) streams in the Vermont Water Quality Standards. An assessment rating of *Good* or better is required to meet minimum biological criteria for Class B(2) streams. The results from the 2018-2020 probabilistic stream survey estimate that **86% of wadeable stream miles in Vermont meet or exceed Class B(2) criteria for macroinvertebrates, and 73% of wadeable streams miles in Vermont meet or exceed Class B(2) criteria for fish.**

Biological condition is Fair or Poor in a small but important percentage of wadeable stream miles in Vermont. Streams that receive assessment ratings of *Fair* or *Poor* for at least one community fail to meet minimum biological criteria for Class B(2) streams outlined in the VWQS. It is estimated that **14% of stream miles in Vermont fail to meet Class B(2) standards for macroinvertebrates, and 27% percent fail to meet Class B(2) standards for fish.** State biologists closely examined biological data, water chemistry results, land use information, and physical habitat characteristics to identify one or more of the ten stressors from the Vermont Surface Water Management Strategy (SWMS) that may be degrading biological condition. For the sites monitored during the 2018-2020 probabilistic survey, **nutrient loading, toxic substances, thermal stress,** and **channel erosion** were identified as major stressors.

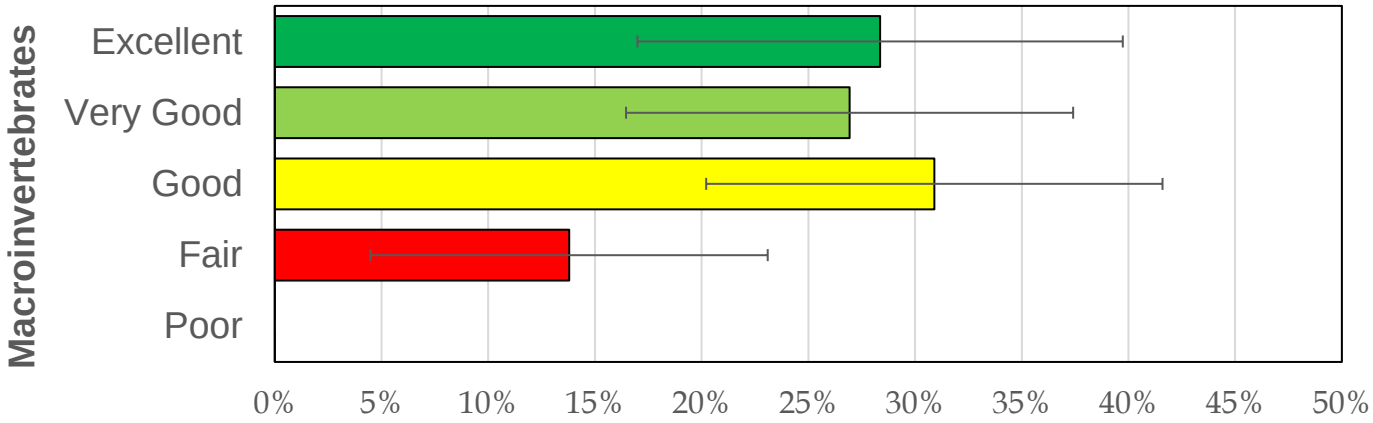

Figure 3. Estimates for the percentage of wadeable stream miles in each assessment category for macroinvertebrates.

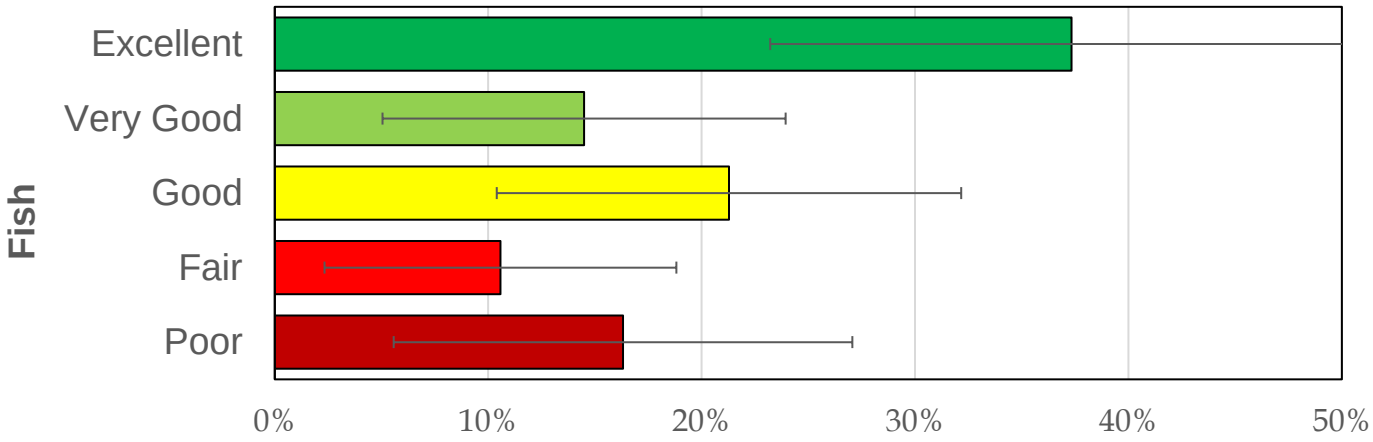

Figure 4. Estimates for the percentage of wadeable stream miles in each assessment category for fish.

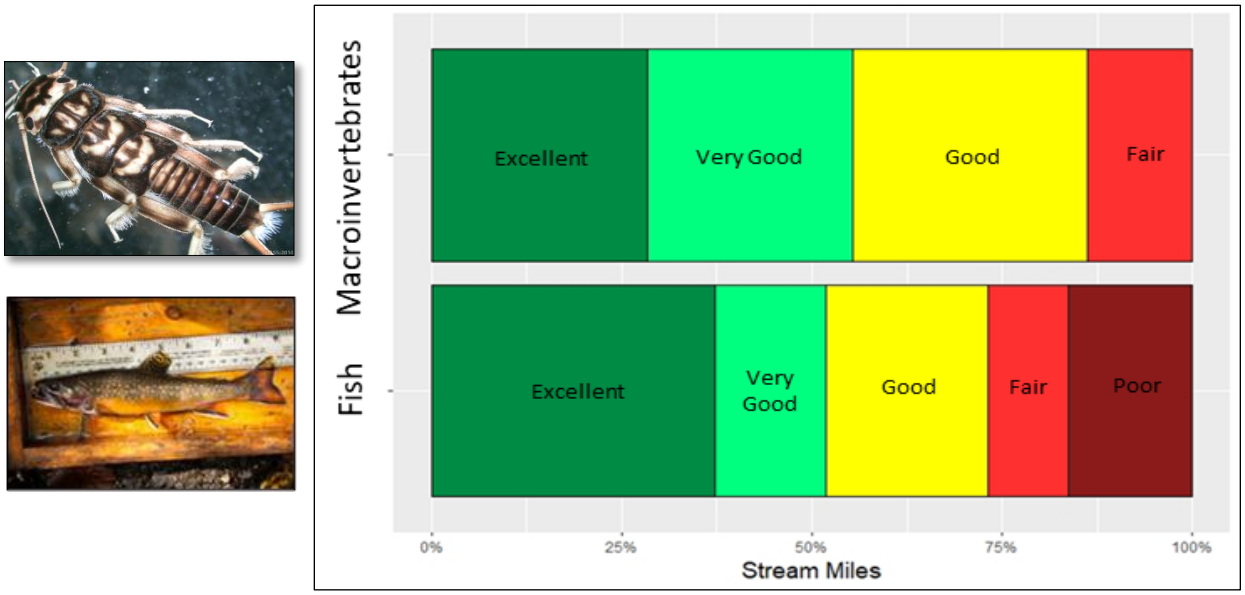

Figure 5. Estimates for percent of stream miles in each assessment category for both macroinvertebrates and fish.

SUMMARY

Protecting both aquatic biota and human uses in streams in or near their natural condition (*Very Good* or better) will become increasingly important as climate change progresses and anthropogenic impacts increase. Strategies such as upward reclassification of streams that consistently meet Class A(1) or Class B(1) standards and site-specific management of these watersheds through the use of individual permits will help to ensure the **protection of Very High Quality streams**. Implementing naturally vegetated riparian buffers, infiltrating runoff from impervious and agricultural land, and conserving critical riparian and watershed areas can help **maintain and enhance** the biological condition in the majority of wadeable streams miles in Vermont that **meet Class B(2) criteria**. When persistent land use practices and multiple anthropogenic stressors on the landscape prohibit protection, maintenance, and enhancement strategies, **stressor-specific restoration efforts** are needed to **restore biological integrity**. Streams that consistently fail to meet minimum biological criteria are reported to the EPA via the 303(d) List of Impaired Waters and require a Total Maximum Daily Load for the identified pollutant.

ACKNOWLEDGMENTS

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A probabilistic monitoring site on a tributary to the North Branch Ottauquechee River, which received an assessment rating of Excellent for both macroinvertebrates and fish.